REMARKS

The pending Office Action addresses claims 1-6, all of which stand rejected. Applicants respectfully request reconsideration based on the remarks submitted herewith.

Double Patenting Rejections

The Examiner maintains his double patenting rejections based on copending Application Serial No. 10/624,823 and Application Serial No. 10/624,746. These rejections are *provisional* since the co-pending applications have not yet been allowed, and Applicants will address these rejections upon allowance of one of the applications.

Inventorship

The Examiner reminds Applicants of the obligation under 37 C.F.R. § 103(a) to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the Examiner to consider the applicability of 35 U.S.C. § 103(c) and potential §§ 102(e), 102(f), 102(g) prior art under 35 U.S.C. § 103(a). As far as it is known to the undersigned, the subject matter claimed was commonly owned at the time any inventions covered herein were made.

Rejections Pursuant to 35 U.S.C. § 103(a)

Claims 1-4 and 6

The Examiner rejects claims 1-4 and 6 pursuant to 35 U.S.C. § 103(a) as being obvious over U.S. Patent No. 5,437,999 of Diebold in view of U.S. Patent No. 5,089,320 of Straus, U.S. Patent No. 5,095,407 of Kanezawa, and a June 2001 Imaging Technologies Update from Enthone. In particular, the Examiner admits that:

> Diebold does not mention (1) whether the working electrode in the embodiment of Figure 5 is non-metal, (2) having the working electrode and the counter or counter/reference electrode spaced from about 20 microns to about 200 microns, and (3) having the effective cell volume be less than 1.5 microliters.

However, the Examiner relies on Straus, Kanezawa, and Enthone to remedy the deficiencies of Diebold. Applicants disagree with the Examiner's rejections.

One aspect of Applicants' invention relates to a biosensor, and more particularly to an electrochemical biosensor for determining the concentration of an analyte in a carrier. Claim 1 recites an apparatus for determining a concentration of glucose in a blood sample that includes a hollow electrochemical cell, a means for applying an electrical potential difference between a working electrode and a counter electrode or counter/reference electrode, and a means for measuring a current between a working electrode and a counter electrode or counter/reference electrode. The hollow electrochemical cell includes at least one non-metal working electrode, and at least one counter electrode or counter/reference electrode. The working electrode and the counter electrode or counter/reference electrode are not coplanar and are separated by a distance of from about 20 to about 200 microns. The cell also includes a spacer interposed between the working electrode and the counter electrode or counter/reference electrode, wherein the spacer comprises a non-conductive polymeric material, and the walls of the spacer and the electrodes define the hollow cell. Additionally, the cell includes a fluid permeable side-wall on at least one side of the hollow cell permitting entry of the sample into the hollow cell, wherein the hollow cell comprises an effective cell volume of less than 1.5 microliters.

Diebold Provides no Motivation for a Smaller Cell Size

Diebold discloses a device that includes a reference or counter electrode element spaced apart from a working electrode element by a spacer. Each electrode element is a multi-layered structure, and includes an insulating substrate, a metalized layer, and a second insulating substrate. The exposed portion of the metalized layer defines Diebold's electrode. Diebold does not, however, disclose the electrode spacing, the thickness of the electrode elements, or the spacing layer. Moreover, Diebold does not teach or even suggest an electrochemical cell where the working electrode and the counter electrode or counter/reference electrode are separated by a distance of from about 20 to about 200 microns, as well as an effective cell volume of less than 1.5 microliters, as set forth in Applicants' claims.

In response to Applicants' arguments made in the last response, the Examiner argues:

> Applicants argue that Strauss "fails to provide any motivation for spacing electrodes according to Applicants' invention." Strauss was only cited to show the technical feasibilty and commercial availability of very thin Mylar sheets. Diebold provides the motivation of desirability of smaller sample size.

Applicants disagree with the Examiner's arguments, as Diebold does not provide the motivation of the desirability of a smaller sample size because decreasing the spacing between the electrodes and the thickness of the intermediate layers would adversely affect the Cottrell analysis that Diebold relies upon to perform accurate measurements.

The Examiner asserts that by including the White patent by reference Diebold is including methods by which deviations from the Cottrell response can be corrected. The Examiner further asserts that the disclosure of White leads to the conclusion that if deviations from Cottrell behavior occur, corrections can be made so that the measurement is still useful. In fact, the very opposite is true. White is concerned with a biosensing system that determines whether a measured current is varying in accordance with a predetermined Cottrell current relationship. If a deviation from Cottrell behavior is detected an error would be flagged and <u>no result reported</u>:

> Accordingly, it is an object of this invention to provide an amperometirc biosensor and method which both provides analyte concentration readings and <u>prevents erroneous readings from being reported as true</u>.
>
> It is another object of this invention to provide an amperometric biosensor and method for glucose concentration which provides <u>an error indication</u>, if an aberrant current curve results. [Emphasis added].

Column 2, lines 52-59 of White. Thus, White does not teach providing the possibility of applying correction factors, but rather teaches that if the current deviates from Cottrell behavior it is to be considered erroneous and provide an error indication and no result. In other words, if the current deviated from Cottrell, the device will not report a result and therefore have no utility

in its intended use. In the context of Diebold, the inclusion of the White reference teaches that deviations from Cottrell behavior cannot be tolerated and should be flagged as an error, not that it provides a correction method as asserted by the Examiner.

The Examiner also refers to Pottgen as providing evidence that 100 microns is all that is needed to get an expected Cottrell signal at particular current flows in the context of the Diebold device. This is not correct. Pottgen discloses the maximum range of times when measurements can be made to be 2 to 30 seconds and preferably 10 to 20 seconds. (See, Column 4, lines 36-40.)

Now, if the electrodes in the Diebold disclosure were 0.1 mm apart, as the Examiner asserts is possible and still get Cottrell behavior, then the current would follow the equations disclosed in the instant application. In general, the shorter the measurement time, the smaller the deviation from Cottrell behavior, so the smallest deviation would be expected at the shortest time disclosed as suitable by Pottgen, that is 2 seconds. So, at a 2 second measurement time with electrodes, opposed as in the Diebold device, spaced apart by 0.1 mm and a diffusion coefficient of 6×10^{-6} cm^2/s, the current flowing would be expected to be:

$$id = 0.00122CFA,$$

where id is the current, C is the concentration of the reduced mediator (here ferrocyanide) in the sample, F is Faraday's Constant, and A is the working electrode area.

The Cottrell current that would be expected under the same conditions (however with the electrodes spaced 1 mm apart) is given by the Cottrell equation in Pottgen and White. This gives the current as:

$$ic = 0.0009772CFA,$$

where ic is the current. The ratio of ic to id is equal to 0.8. So, at 2 seconds there is a 20% difference between the currents. In Column 4, lines 53-55, Pottgen gives a generally acceptable error range of 1-10%. So at the shortest time disclosed by Pottgen, where the error between the

two cases is expected to be least, the device of Diebold could be expected to give an error double that deemed as the maximum acceptable by Pottgen.

The device of Diebold will only work if the electrodes are spaced sufficiently far apart such that significant deviations from Cottrell behavior do not occur. The Examiner asserts that 0.1 mm is still an acceptable spacing according to Pottgen. However, the calculations above show that even at the shortest measurement time disclosed by Pottgen, where deviations from Cottrell are least likely, the deviation from Cottrell current expected in a Diebold like device will be *double* the maximum error deemed as acceptable by Pottgen. Thus, one attempting to combine the teaching of Diebold and Pottgen would conclude that an electrode spacing closer to 1 mm, and certainly greater than 0.1 mm, is necessary for the Diebold device to be operable. Further, and in view of the above, Pottgen in combination with Diebold teaches away from an electrochemical cell where the working electrode and the counter electrode or counter/reference electrode are separated by a distance of from about 20 to about 200 microns, as well as an effective cell volume of less than 1.5 microliters, as required by Applicants' claims.

Accordingly, because Diebold for all practical purposes is inoperable with decreased spacing in the context of White and Pottgen, one having ordinary skill in the art would have no motivation to decrease the spacing between the Diebold layers.

One Having Ordinary Skill in the Art would have No Motivation to Combine Diebold, Straus, Enthone, and Kanezawa

In addition to the above, one having ordinary skill in the art would have no motivation to combine Diebold with Straus, Enthone, and Kanezawa. The cited references are directed towards different fields, and solving problems unique to those fields. Diebold is directed towards the field of *biosensors*, and teaches a method for fabricating high-resolution, biocompatible electrodes that allow production of an electrochemical sensor. The Diebold sensor is capable of precise analyte concentration determination on a very small sample size. Straus, in contrast, is directed towards the field of *packing materials* and teaches a resealable packing material comprised of several layers laminated together. Further, Enthone and

Kanezawa are both directed towards *printed circuit boards*. In particular, Enthone teaches a technique for optimizing the ENDPLATE DSR application that allows the user to control the amount of solder mask being deposited onto the printed circuit panel to obtain a specific thickness. Kanezawa teaches a double sided memory board that is formed using Mylar film of a certain thickness in order to form a circuit board having an improved reliability. Because all of the references cited by the Examiner are directed towards different technological fields, as well as solving problems that are unique to those technological fields, one having ordinary skill in the art would have no motivation to combine Diebold with Straus, Enthone, and Kanezawa.

Diebold, Straus, Enthone, and Kanezawa do not Teach or Even Suggest the Recitations of Applicants Claims

Even if one having ordinary skill in the art would have motivation to combine the references, Diebold in view of Straus, Enthone, and Kanezawa do not teach or suggest an electrochemical cell with an effective volume of less than 1.5 microliters, where the working electrode and the counter electrode or counter/reference electrode are separated by a distance of from about 20 to about 200 microns. As noted by the Examiner, Diebold does not teach or suggest an electrochemical cell as recited by claim 1. Straus does not remedy the deficiencies of Diebold, as Straus does not teach or even suggest an electrochemical cell having a working electrode and a counter electrode or counter/reference electrode that are separated by a distance of from about 20 to about 200 microns as well as an effective cell volume of less than 1.5 microliters. In fact, Straus does not teach any type of electrodes that are spaced apart from one another. Instead, Straus teaches a resealable flexible packaging material that is unrelated to electrochemical cells. Additionally, Enthone and Kanezawa also do not teach or suggest a electrochemical cell where the working electrode and the counter electrode or counter/reference electrode are separated by a distance of from about 20 to about 200 microns as well as an effective cell volume of less than 1.5 microliters. Rather, Enthone and Kanezawa teach a circuit board having wires formed thereon, and fail to teach electrodes that are separated by a distance of from about 20 to about 200 microns, much less a cell having an effective cell volume of less than 1.5 microliters, as set forth in claim 1.

Accordingly, one having ordinary skill in the art would have no motivation to combine the references, and the references do not teach or even suggest the recitations of claim 1. As such, claim 1, as well as claims 2-4 and 6 which are dependent thereon, distinguish over Diebold in view of Straus, Enthone, and Kanezawa and represent allowable subject matter.

The Present Rejection Should be Withdrawn because Straus, Enthone, and Kanezawa are Non-Analogous Prior Art

Applicants further note that the present rejection should be withdrawn because Straus, Enthone, and Kanezawa are non-analogous prior art. MPEP § 2141.01(a) states:

> In order to rely on a reference as a basis for rejection of an applicant's invention, the reference must either be in the field of applicant's endeavor, or, if not, then be reasonably pertinent to the particularly problem with which the inventor was concerned.

MPEP § 2141.01(a) further states:

> A reference is reasonably pertinent if, even though it may be in a different field from that of the inventor's endeavor, it is one which, because of the matter with which it deals, logically would have commended itself to an inventor's attention in considering his problem.

As noted above, one aspect of Applicants' invention relates to a biosensor, and more particularly, an apparatus that includes a hollow electrochemical cell for measuring a concentration of an analyte (i.e., glucose) in a blood sample. Straus is directed to a flexible packaging material that is resealable by the application of pressure alone at the area of a seal formed by a packaging machine. Thus, the Straus device is in a different field than Applicants' invention. Further, Straus is concerned with the resealability of the packaging materials. The resealability of package material would not have "logically commended itself" to Applicants when considering their problem of measuring a concentration of an analyte (i.e., glucose) in a blood sample.

In a like manner, Enthone and Kanezawa are also non-analogous art. Both Enthone and Kanezawa are directed towards the formation of printed wiring boards for the use in electronics. In particular, Kanezawa is focused upon making a board where the number of thru-holes is reduced by a large margin in order to improve the reliability of the board, and Enthone is focused on an endplate application process that allows the user to control the amount of solder mask being deposited onto the printed circuit panel to obtain a specific thickness. Thus, both the Enthone and Kanezawa devices are in fields that are different than Applicants' invention, and the formation of improved printed wiring boards is not reasonably pertinent to measuring the concentration of an analyte in a blood sample.

Accordingly, because the Examiner relies upon non-analogous art in his rejection, the rejection should be withdrawn.

Claim 5

The Examiner rejects claim 5 pursuant to 35 U.S.C. § 103(a) as being obvious over Diebold in view of Straus, Kanezawa, Enthone, and further in view of U.S. Patent No. 5,126,034 to Carter and U.S. Patent No. 5,399,256 to Bohs. Applicants disagree with the Examiner's rejection. As noted above, Diebold in view of Straus, Kanezawa, and Enthone do not teach or even suggest an electrochemical cell that has a working electrode and a counter electrode that are separated by a distance of from about 20 to about 200 microns, as well as a cell having an effective cell volume of less than 1.5 microliters. Carter and Bohs do not remedy the deficiencies of Diebold, Straus, Kanezawa, and Enthone as they do not teach or suggest an electrochemical cell that has a working electrode and a counter electrode that are separated by a distance of from about 20 to about 200 microns, as well as a cell having an effective cell volume of less than 1.5 microliters. Accordingly, at least because it is dependent upon an allowable base claim (claim 1), claim 5 distinguishes over Diebold in view of Straus, Kanezawa, Enthone, and further in view of Carter and Bohs, and represents allowable subject matter.

Conclusion

In view of the above, each of the presently pending claims in this application is believed to be in immediate condition for allowance. Accordingly, the Examiner is respectfully requested to pass this application to issue. The Examiner is kindly requested to telephone the undersigned representative in the event that the amendments do not place this case in condition for allowance or if a telephone interview can otherwise expedite the prosecution of this application.

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Respectfully submitted,

By_______________

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